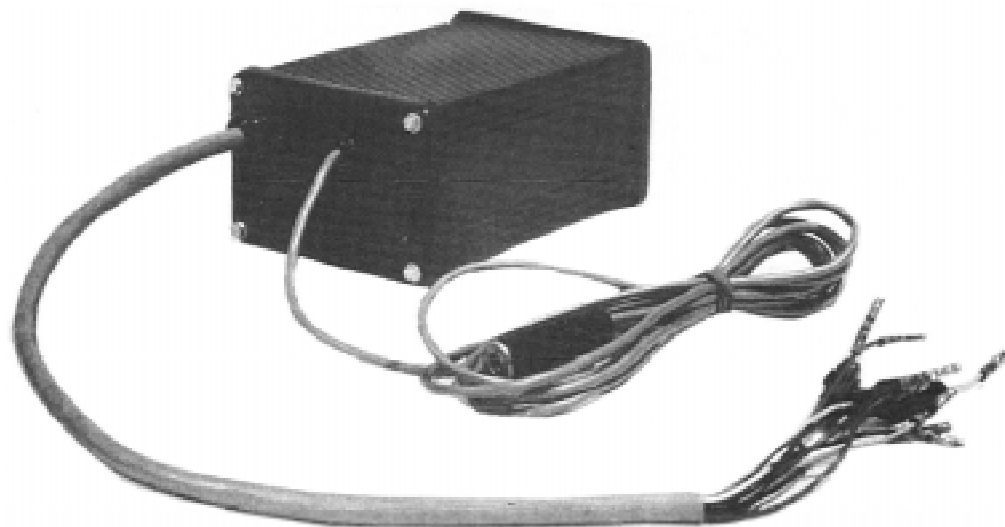


PRICE \$2.00



MODEL PA500M*

AMPLIFIER



SERVICE MANUAL

LIMITED WARRANTY

The Signal Division, Federal Signal Corporation (Federal), warrants each new product to be free from defects in material and workmanship, under normal use and service, for a period of two years on parts replacement and one year on labor from the date of delivery to the first user-purchaser.

During this warranty period, the obligation of Federal is limited to repairing or replacing, as Federal may elect, any part or parts of such product which after examination by Federal discloses to be defective in material and/or workmanship.

Federal will provide warranty for any unit which is delivered, transported prepaid, to the Federal factory or designated authorized warranty service center for examination and such examination reveals a defect in material and/or workmanship.

This warranty does not cover travel expenses, the cost of specialized equipment for gaining access to the product, or labor charges for removal and re-installation of the product. Lamps, flash tubes, or batteries are not covered under warranty.

This warranty does not extend to any unit which has been subjected to abuse, misuse, improper installation or which has been inadequately maintained, nor to units which have problems relating to service or modification at any facility other than the Federal factory or authorized warranty service centers.

THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL FEDERAL BE LIABLE FOR ANY LOSS OF PROFITS OR ANY INDIRECT OR CONSEQUENTIAL DAMAGES ARISING OUT OF ANY SUCH DEFECT IN MATERIAL OR WORKMANSHIP.



FEDERAL SIGNAL CORPORATION

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SECTION I

GENERAL DESCRIPTION

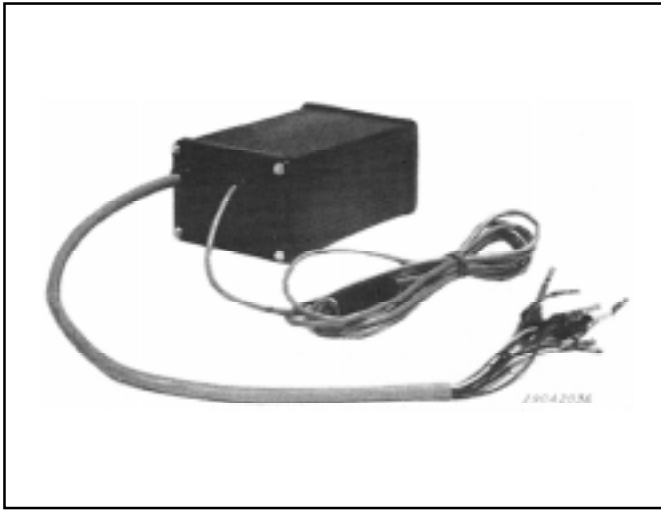


Figure 1. Model PA500 Amplifier.

The Federal Model PA500M* Amplifier is a precision built, reliable electronic siren incorporating state-of-the-art CMOS technology. The siren operates from a nominal 12Vdc, negative ground, electrical system. It is capable of operating with one 58-watt speaker or one 100-watt speaker. (Model PA500M* comes factory set for a 58-watt output.) The factory set output can be changed, as described in Section IV of this manual.

The standard operating functions of this siren are Wail, Tap II, Yelp and manual peak-and-hold. The Tap II feature allows the driver to change the siren sound from wail to yelp via the vehicle's horn ring. Tap II provides an especially effective traffic clearing capability.

The siren also has provisions for public address (PA) operation. An optional Federal Model MNCT Microphone is required if it is desired to make use of the PA capability.

Its splashproof enclosure complies with SAE specification J1211 for splashproof testing. Available shock and vibration mounting hardware make it an ideal choice for a motorcycle siren. Installation instructions are contained in a separate document included with this siren.

The siren's power/control cable is terminated with bullet connectors. These connectors mate with connectors from the control head, power source and speaker to provide a quick, easy installation. Also, the unit's slide-in/out design facilitates servicing.

SECTION II

SPECIFICATIONS

Input Voltage	11Vdc to 16Vdc
Polarity	Negative ground only
Standby Current	30mA \pm 5mA
Operating Temperature Range.	-30°C to +65°C
Operating Current (14Vdc, Wail)	4.5 amperes (58 watt) 7.0 amperes (100 watt)
Frequency Range	500 to 1500Hz
Cycle Rate	Wail - 12 cycles/minute (nominal) Yelp - 180 cycles/minute (nominal)
Voltage Output (approx.)	45V p-p (58 watt) 60V p-p (100 watt)
Audio Frequency Range	300 to 10KHz
Harmonic Audio Distortion (300-3KHz)	10% max. all power levels from 1/2 to 50 watts
Input Voltage Required to Obtain 15Vrms across Speaker Load	0.5Vrms
Dimensions (HWD - less mtg. brkt.)	3.05" x 4.36" x 6.38"
Net Weight	4-1/2 pounds
Shipping Weight	6-1/2 pounds

SECTION III

CIRCUIT DESCRIPTION

Refer to the block diagram (figure 2) and schematic diagram (figure 3) while reading this section.

3-1. RATE OSCILLATOR AND VOLTAGE CONTROLLED OSCILLATOR.

The rate oscillator and voltage controlled oscillator (VCO) sections are the "heart" of the Model PA500 circuitry. Not only does the rate oscillator determine the cycling rate of each siren tone, but it also generates the control voltage that operates the VCO. The VCO generates a square-wave output whose frequency is directly proportional to the control voltage. The output of the VCO is coupled to the siren preamplifier.

The siren rate oscillator consists of an LM555 timer configured as an astable oscillator. The astable oscillator (IC3) employs an analog switch (IC5C) to select the RC timing network which determines the astable oscillator's timing rate. IC5B, another analog switch, connects the discharge pin of IC3 to the RC timing network. When the peak function is called for, the control pin IC5-pin 5 goes to a logic "0" putting the switch in a high impedance state (OFF). Simulta-

neously, control pin IC5C-pin 6 goes to a logic "1" and allows the siren to charge at a yelp rate until the tone peaks.

IC1, a phase-locked loop, contains the voltage controlled oscillator. C8, R1, R5, R13 and the control voltage on IC1-pin 9 determines the output frequency. As the siren coasts down in the manual mode, the output of the VCO must be disabled to prevent frequencies lower than 350Hz from damaging the amplifier's output transistors. IC2, a voltage comparator, compares the VCO control voltage to the low frequency reference voltage set by R15 and R23. When the VCO control voltage drops below the reference, IC2-pin 7 goes to a logic "1" through OR gate IC4B. The VCO is also inhibited when the microphone push-to-talk input is selected. This logic level is gated through IC8D and IC4B to the VCO inhibit pin.

3-2. SIREN MODE CONTROL.

The wail mode is controlled by a logic "0" at IC8A. Through IC8A, the astable oscillator is enabled and the wail function is produced. While the wail mode is activated, the yelp mode may be selected by a logic "0" at IC8C. Through IC7 and IC8, flip-flop IC6 changes state and brings control pin IC5-pin 6 to a logic "1" thus switching in the necessary RC network to produce the yelp signal.

The manual mode is enabled with the siren in the standby mode and IC8C-pin 11 at a logic "0". IC4C, IC5B, IC5C and IC7B provide the necessary decoding for the manual mode.

3-3. AUDIO SECTION.

The amplifier system consists of MOSFET/ Bipolar complementary voltage and power gain amplifiers. The circuit consisting of Q5, Q6, Q7 and Q8 use both AC and DC feedback to insure stability and maximum linear signal swing. The overall mid-band voltage gain is set by the ratio of feedback resistor R43 and Q5 source resistor R16. Frequency compensation is set by the combination of C3, R28 and C27.

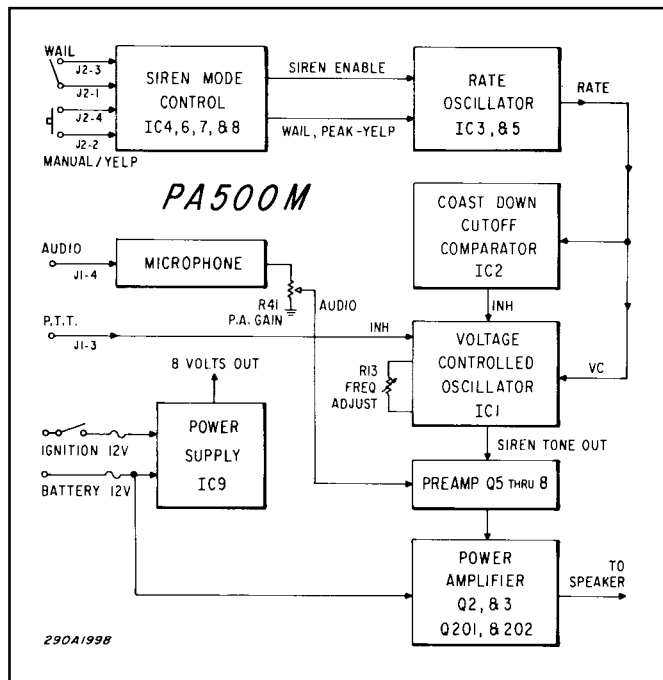


Figure 2. Block Diagram.

Audio signal levels are coupled to the amplifier through R41. An input voltage of approximately 250mV is required to drive the amplifier to full rated sine wave power. This level is produced by the transistorized MNCT* microphone in the PA mode.

The amplifier enable line uses a relay (K1) to disable the amplifier section, when neither siren or PA functions are needed.

Temperature compensation and bias current for minimizing crossover distortion is supplied by

thermistor RT1 and the voltage divider (R1 and R12) across diode reference CR2. Q1 is used to switch the bias "on" during PA messages.

3-4. POWER SECTION.

The ignition line supplies B+ to the printed circuit board. Networks consisting of C18, CR6, CR7 and C17 provide input filtering for voltage regulator LM7808. B+ from the battery supplies bias to the output section consisting of T201, Q201 and Q202.

SECTION IV SERVICE AND MAINTENANCE

SAFETY MESSAGE TO PERSONNEL SERVICING FEDERAL SIGNAL ELECTRONIC SIRENS

The lives of people depend on your safe servicing of Federal products. It is important to follow all instructions shipped with the products. In addition, listed below are some other safety instructions and precautions you should follow:

- Read and understand all instructions in this manual before servicing this equipment.
- To properly service an electronic siren, you must have a good understanding of automotive electrical systems and emergency signalling procedures.
- All effective sirens and horns produce loud sounds which may cause, in certain situations, permanent hearing loss. You should take appropriate safety precautions such as wearing hearing protection.
- In order for the electronic siren to function properly, the ground connection must be made to a solid chassis component and not to an insulated point.

Failure to follow all safety precautions and instructions may result in property damage, serious injury, or death to you or others.

4-1. UNPACKING.

After unpacking the siren, examine it for damage that may have occurred in transit. If the equipment has been damaged, file a claim immediately with the carrier stating the extent of the damage.

Carefully check all envelopes, shipping labels and tags before removing or destroying them.

4-2. GENERAL.

Most of the electronic component parts used in the PA500M* are standard items that are available at almost any radio or electronics supply outlet.

The factory can and will service your equipment or provide technical assistance with problems that cannot be handled satisfactorily and promptly locally.

If any unit is returned for adjustment or repair, it can be accepted only if we are notified by mail or telephone in advance of its arrival. Such notice should clearly indicate the service requested and give all pertinent information regarding the nature of the malfunction and, if possible, its cause.

Address all communications and shipments to:

Service Department
Federal Signal Corporation Signal Division
2645 Federal Signal Drive
University Park, IL 60466
1-800-433-9132

When replacing small components, use care when soldering. Heat easily damages integrated circuits, transistors, capacitors and circuit boards. Therefore, it is advisable to use a heat sink on the component lead being soldered.

4-3. MODIFICATIONS.

The following paragraphs describe modifications which can easily be made to the Model PA500M* by a qualified service technician. Before any of the

modifications can be attempted, the front cover must be removed. The screws which secure the front cover to the housing should be removed with a 1/4-inch wrench or flat blade screwdriver. Slide the chassis out of the housing.

A. Output Power Modification.

NOTE

The Model PA500M* comes factory set for a 58-watt output.

Locate the 12-position terminal strip on the output PC board (see figure 5). Using a flat blade screwdriver, move the orange wire to the described position.

TB201, pin 1 for 58-watt output.
TB201, pin 2 for 100-watt output.

B. Coast Down Elimination.

The Model PA500M* comes from the factory wired so that it will coast down after a siren function has been deactivated. To eliminate the coast down feature, and have the siren sound come to an abrupt stop when the siren function is deactivated, proceed as follows (see figure 4):

1. Remove the main PC board by unplugging J1, J2, J3 and removing the four PC board screws.
2. Cut jumper wire (JU2) labeled FAST PEAK.

3. Install jumper wire (JU1) at position labeled SLOW PEAK.

4. Install a 100-ohm, 1/4watt, resistor at position labeled CUTOFF.

5. Reinstall the PC board with the four screws removed in step 1. Install J1, J2 and J3. Insure that the polarization of the connectors is correct.

4-4. PA GAIN ADJUSTMENT.

The Model PA500M* comes from the factory with the PA gain set to maximum. To decrease the gain setting, proceed as follows (see figure 4):

A. Remove the four screws which secure the front cover to the housing. Slide the chassis out of the housing.

B. Locate R41 (PA) on the main PC board.

C. Using a small flatblade screwdriver, rotate R41 counterclockwise to a desired volume setting.

D. Reinstall the chassis in the housing and secure the front cover.

4-5. TESTING.

After servicing, modification, or adjustment is completed; perform a test of all functions to ensure siren is operating properly.

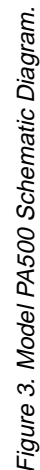


Figure 3. Model PA500 Schematic Diagram.

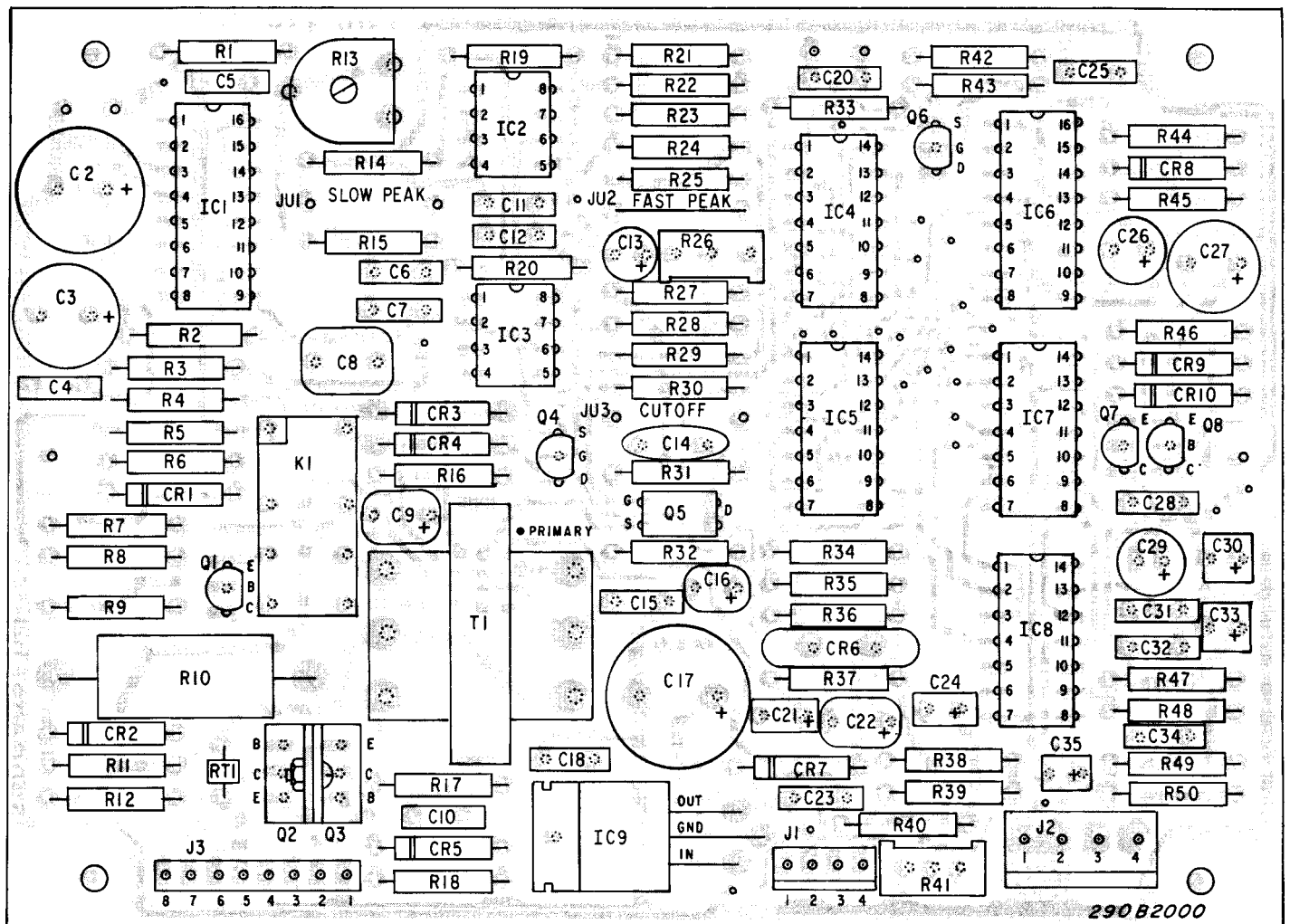


Figure 4. Main Board Component Location Diagram.

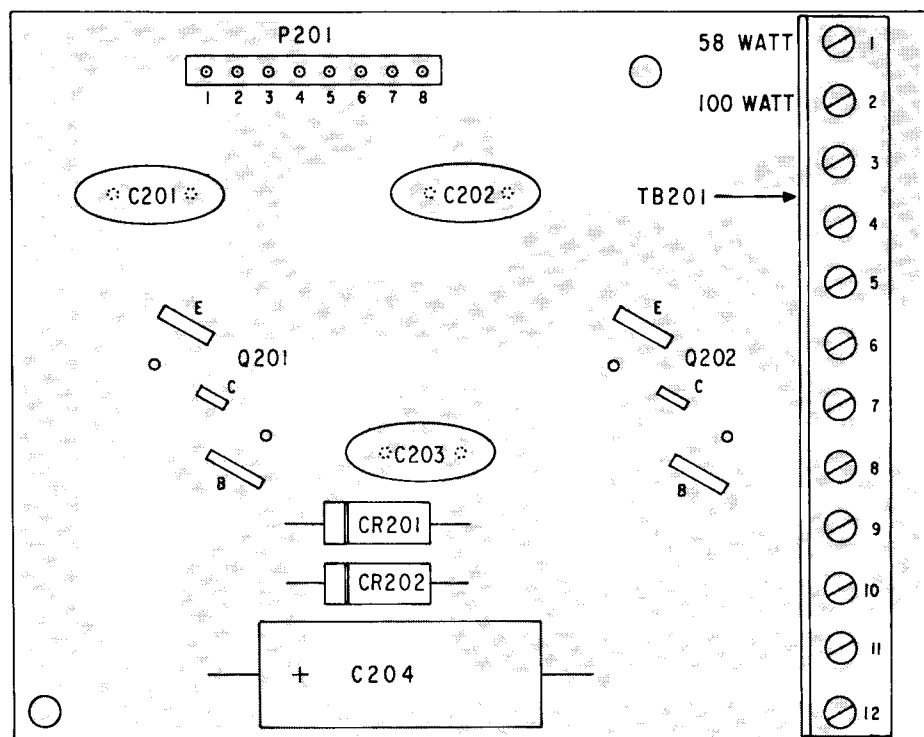


Figure 5. Output Board Component Location Diagram.

PARTS LIST MODEL PA500 AMPLIFIER

Schematic Symbol	Description	Part No.	Schematic Symbol	Description	Part No.
*RESISTORS			CAPACITORS (Cont'd.)		
R1	68K Ohm, 5%	100A261	C17	1000UF, 35V, Electrolytic	108A149
R2	2200 Ohm	100A221	C22	6.8UF, 15V, Tantalum	107A604
R3	33 Ohm	100A288	C24,30,33,35	0.47UF, 35V, Tantalum	107A645
R4,7,17	10 Ohm	100A251	C29	22UF, 16V, Electrolytic	108A144
R5,22	1.5 Megohm, 5%	100A726	C203	0.001UF, 100V, Disc	107A207
R6,18	150 Ohm	100A238	C204	500UF, 15V, Electrolytic	108A122
R8	5600 Ohm	100A253			
R9	2700 Ohm	100A206		DIODES	
R10	270 Ohm, 2 Watt, WW	103A128			
R11	8. 2 Ohm	100A743	CR1,2,3,4,5,7	CL-1 (ED3002S)	115B301
R12	27 Ohm	100A250	CR6	V18ZA3, Varistor	114A103
R13	200K Ohm, Potentiometer	106A203A-03	CR8,9,10	T155	115B101
R14	33K Ohm, 5%	100A771	CR201,202	1N5400	115A105
R15,28,43, 48,50	1000 Ohm	100A233			
				INTEGRATED CIRCUITS	
R16	220 Ohm	100A219			
R19,23	100K Ohm, 5%	100A262	IC1	MC14046BCP	128B079
R20	56K Ohm, 5%	100A704	IC2	LM358	128045
R21,33,42, 44,47,49,	10K Ohm	100A207	IC3	LM555N	128A043A-04
R24,25,30, 37,38,40	4700 Ohm	100A224	IC4	MC14071BCP	128B082
			IC5	MC14066BCP	128047
			IC6	MC14027BCP	128A044
R26	250K Ohm, Potentiometer	105A255	IC7	CD4093BE	128B093
R27,31	3300 Ohm	100A209	IC8	MC14584B	128A059
R29	180K Ohm	100A706	IC9	UA78M08CKC	128A097
R32	150K Ohm	100A226			
R34	1000 Ohm, 2%	100A712		TRANSISTORS	
R35	220K Ohm, 2%	100A719			
R36	15K Ohm, 5%	100A239	Q1,7	TIS92, NPN	125B132
R39	470 Ohm	100A255	Q2,3	2N6109, PNP	125B431
R41	10K Ohm, Potentiometer	105A263	Q4,6	SD1124, FET	125A153
R45	68K Ohm, 5%	100A261	Q5	IRFD9123, FET	125A162
R46	15 Ohm	100A291	Q8	TIS93, PNP	125B133
			Q201,202	2N5885, NPN	125B432
*Unless otherwisc specified; all RESISTORS are carbon type, ±10%, 1/4 Watt.			MISCELLANEOUS		
CAPACITORS			T1	Transformer, Driver	120B145
			T201	Transformer, Output	120B140A-01
C2	330UF, 50V, Electrolytic	108A153	RT1	Thermistor, 200-ohm	104A111
C3,27	150UF, 16V, Electrolytic	108A147	TB201	Terminal Strip, 12-position	229A164
C4, 10,15,18	0.001UF, Film	107A771	J1	Connector, Wafer, 4-pin	140A202
C5,6,11, 20,23,25,28	0.01UF, Film	107A767	J2	Connector, Wafer, 4-pin	140A212
C7,12,31,32,34	120PF, 200V, Mono.	107A1004	J3,J201	Connector, Wafer, 8-pin	140A170
C8	0.015UF, 100V, Poly.	107A766	K1	Relay, 12V, DPDT	131A130A-01
C9	3.9UF, 15V, Tantalum	107A642		PC Board, Main (without parts)	130C339
C13,26	10UF, 16V, Electrolytic	108A143		PC Board, Main (with parts installed)	200C906
C14,201,202	0.005UF, 100V, Disc	107A211		PC Board, Output (without parts)	130C338
C16,21	1.0UF, 50V, Tantalum	107A649		PC Board, Output (with parts installed)	200C905

